# Task 2.1

How does the frequency and location of excessive PM concentrations vary from year-to-year? At what locations and during what seasons are state and federal standards exceeded? How well did the 1999/2001 CRPAQS field study represent the numbers and locations of $PM_{2.5}$ and $PM_{10}$ exceedances found over a longer record?

## 1. Introduction

Concentrations of particulate matter in California vary from place to place and from season to season. These large differences in concentrations are caused by variations in emission sources and meteorology. The size and chemical composition of particles can also vary considerably.

The federal government and the State of California have established both 24-hour and annual ambient air quality standards for $PM_{10}$ and $PM_{2.5}$ National Ambient Air Quality Standards apply to $PM_{2.5}$ and $PM_{10}$ mass concentrations. The national PM standards specify the following limits:

- Twenty-four-hour average $PM_{2.5}$ not to exceed 65 $\mu g/m^3$ for a three-year average of annual $98^{th}$ percentiles at any community-representative (core) site in a monitoring area.
- Three-year annual average $PM_{2.5}$ not to exceed 15 $\mu g/m^3$ from a single community-representative (core) site or the spatial average of eligible community-representative sites in a monitoring area.
- Twenty-four-hour average $PM_{10}$ not to exceed 150 $\mu g/m^3$ more than once a year over a three-year period at any site in a monitoring area. This is calculated as an expected number of exceedances for sampling that is less than everyday.
- Three-year average of annual arithmetic means of $PM_{10}$ concentrations not to exceed 50 $\mu g/m^3$ at any site in a monitoring area.

In contrast to the national PM standards, California has set its own State standards for $PM_{10}$. The designation criteria for the State standards specify the following limits:

- Twenty-four-hour average $PM_{10}$ not to exceed 50 $\mu g/m^3$ during a three-year period at any site in a monitoring area, excluding exceedances affected by highly irregular or infrequent events.
- Annual geometric mean of $PM_{10}$ concentrations not to exceed 30 $\mu g/m^3$ during a three-year period at any site in a monitoring area.

In May 2002, the California Air Resources Board approved the revision of the State $PM_{10}$ annual average standard lowering it's level to 20 $\mu g/m^3$ and adopted

an annual average $PM_{2.5}$ standard of 12 μg/$m^3$. Senate Bill 25 (Chapter 731, Statutes of 1999), signed by Governor Davis on October 7, 1999, requires the Air Resources Board (ARB) to review all existing State standards to determine whether they adequately protect public health, including infants and children, with an adequate margin of safety. State standards found to be inadequate will be revised, based on a priority ranking. The requirements of Senate Bill 25 put a special emphasis on infants and children because they may be more susceptible to the health effects of air pollutants than adults. Reasons for their higher susceptibility include higher relative ventilation rates, narrower airways, developing organs and tissues, and greater exposure because of increased time spent outdoors.

## 2. Objectives

The primary objective of Task 2.1 is to analyze the year-to-year variations in the PM concentrations using ARB's long-term database and the CRPAQS database. The analyses in Task 2.1 will focus on a study domain, which for the purpose of this task will be defined as all of California, except South Coast and San Diego air basins and Imperial County.

The specific objectives of this task are:

- Examine site-to-site variations in annual, 24-hour, and hourly PM concentrations between 1990 and 2001.
- Rank sites based on the annual, 24-hour, and 1-hour concentrations for each year between 1990 and 2001.
- Compare the ranks from year to year to determine the following:
  - Does the relative ranking remain the same from year to year?
  - Do the sites with the highest annual concentrations also have the highest 24-hour concentrations and 1-hour concentrations?
- Examine the frequency of excessive PM concentrations by calculating the percent of samples that exceed relevant State and federal standards.
- Determine if the frequency of excessive concentrations changes from year to year.
- Determine which standards are more commonly exceeded, annual or daily?
- Investigate seasonal changes in the magnitude of PM concentrations and in the frequency of PM concentrations above relevant standards.
- Compare the long-term database with the CRPAQS database based on the following parameters:
  - Average PM concentrations.
  - Location and magnitude of highest PM concentrations.
  - Location and frequency of excessive concentrations.

## 3. Technical Approach

### A. Ambient Data Included in the Analyses

Ambient data collected as part of the routine monitoring network as well as CRPAQS data will be included in the analysis. Table1 lists PM parameters, along with the measurement method, that will be analyzed in Task 2.1. Routine network data for 1990-2001 will be included in the analysis.

The CRPAQS field study consisted of a long-term campaign from 12/1/1999 through 1/31/2001, a winter intensive study within the period of 12/1/2000 through 2/3/2001, and a fall intensive study within the period of 10/8/2000 through 11/15/2000.

**Table 1. PM Parameters**

| PM Parameters | Routine Network | CRPAQS |
|---|---|---|
| $PM_{10}$ 24-Hour | SSI, Dichot | DRI Sequential Filter Sampler (SFS), Minivol |
| $PM_{10}$ Continuous | TEOM | BAM |
| $PM_{2.5}$ 24-Hour | FRM, Dichot, Speciation | DRI SFS, Minivol |
| $PM_{2.5}$ Continuous | BAM | BAM |
| PM Coarse | Dichot | |

### B. Types of Analysis and Data Presentation

The routine data for 1990-2001 as well as CRPAQS data will be analyzed for the following parameters:

- Number of samples.
- Data completeness (as specified in the Code of Federal Regulations).
- Annual arithmetic and geometric means.
- Maximum concentrations.
- Average concentration by month.
- Number and percent of samples that exceed relevant standards annually, quarterly, and monthly.
- Comparison to the standards.

Data presentation will include tables and graphs to illustrate the following:

- Variations in concentrations from year-to-year and from site-to-site. Graphical presentation will include time series graphs, bar graphs, and box and whisker plots of minimum, mean, and maximum concentrations.

- Frequency distribution of observed PM concentrations presented as histograms.
- Frequency of concentrations above relevant standards.
- Seasonal variations in concentrations.
- Comparison of CRPAQS data set with the long-term record.

The final report will include descriptive summary of findings including tables and graphs.

## 4. Schedule

The schedule for completion of milestones is shown in Table 2.

**Table 2. Schedule**

| Completion Date | Task |
|---|---|
| September 2002 | Calculate data statistics for routine monitoring network. |
| October 2002 | Calculate data statistics for CRPAQS monitoring network. |
| November 2002 | Compare CRPAQS summary statistics with long-term records.<br>Analyze data and summarize preliminary findings. |
| January 2003 | Prepare final data summaries and graphs. |
| February 2003 | Prepare final report. |